This novel and ingenious idea was never practically tried, but it established the fact that Hughes was the inventor of oil insulation.

In 1878 he brought out the microphone. No one who remembers the period can ever forget the sensation produced by his simple apparatus and striking experiments. Bell had just brought out the telephone, Edison had patented his carbon transmitter and invented the phonograph; but Hughes captured the town by causing the footsteps of a house fly to resound like the tread of an elephant.

In 1879 he showed how to eliminate the effects of mutual induction from lateral wires by using a metallic circuit and twisting the wires around each other.

This was followed by his beautiful induction balance, and subsequently by a series of elegant researches in magnetism and inductance. Hughes was essentially an experimenter. His manipulation of rough materials was phenomenal. He scorned the scientific instrument maker. Pill boxes, common nails, sealing wax, bonnet wire, knitting needles, tumblers, cheap copper were enough for him. His cells, galvanometers and telephones were all home-made. He was not a mathematician, nor was he deeply versed in scientific literature; but he had an instinctive perception of truth, and he jumped by intuition to facts which he could speedily verify with his own hands in the crudest fashion and by the homeliest aid. He loved science, and his constant attendance at the Royal Society and the Royal Institution evidenced his interest in scientific progress.

The Royal Society presented him with a Royal Medal in 1885, and he was awarded the Albert Medal by the Society of Arts in 1897. He was President of the Institution of Electrical Engineers in 1886, and was for many years a manager of the Royal Institution.

He was a genial, charming companion, and his presence will be very much missed by many who knew him well.

The funeral of Prof. Hughes took place on Saturday, January 27. The pall bearers were Lord Lister, Prof. A. W. Rücker, Mr. Choate (the United States Ambassador), Prof. S. P. Thompson, Prof. Dewar and Major-General Webber. Among the other men of science present at the special service at All Souls', Langham Place, some of whom went on to Highgate Cemetery, where the interment took place, were Mr. E. Clodd and the Servian Consul, Lord Kelvin, Sir William Crookes, Sir Frederick Bramwell, Dr. J. H. Gladstone, Dr. Johnstone Stoney, Sir Henry Mance, Mr. R. E. Crompton, Prof. Perry, Prof. Meldola, Mr. A. Siemens, Mr. A. B. Kempe, Mr. J. Swinburne, Mr. J. Wimshurst, M. Dæschner (secretary of the French Embassy), the Greek Chargé d'Affaires, Sir F. Abel, Sir H. T. Wood, Mr. A. P. Trotter and Mr. C. E. Spagnoletti. The Duke of Northumberland and Sir W. Preece were represented.

NOTES.

THE Geological Society of France has received a legacy of forty thousand francs from Mme. Beaucourt, for the encouragement of investigations which assist geological progress.

THE *Engineer* states that the War Office is making an allowance of 3000*l.* for the provision of apparatus for use by the electrical engineer volunteers going to South Africa.

THE Institute of France has accepted the conditions of the gift by M. Daniel Osiris of a sum of money for the foundation of a triennial prize of one hundred thousand francs, to be awarded for the most remarkable discovery or work in science, art, or letters.

THE Special Meeting of the Manchester Literary and Philosophical Society for the presentation of the Wilde and Dalton Medals, and for the delivery of the Wilde Lecture on "Flight, natural and artificial," by Lord Rayleigh, F.R.S., will be held on Tuesday, February 13, at 4.30 p.m.

THE death is announced of General Alexis de Tillo, the distinguished Russian geographer, and correspondant of the Paris Academy of Sciences, in the section of geography and navigation. For more than twenty years General Tillo was one of the most active and earnest members of the Russian Imperial Geographical Society, and contributed many papers on the hypsometry, terrestrial magnetism, and climatology of Russia.

BARON LE BAUME PLUVINEL, who has been to Spain on behalf of the French Astronomical Society, to inquire into the weather prospects during the forthcoming solar eclipse at various places along the line of totality, and to make arrangements for the accommodation of the members who will go to observe it, will give an address to the Society on February 7, on the results of his visit.

THE twenty-seventh annual dinner of the old students of the Royal School of Mines was held at the Hotel Cecil on Friday, January 26. Mr. H. G. Graves was in the chair, and was presented with a loving cup, &c., in consideration of his service for several years as secretary, by Mr. H. Bauerman, on behalf of the committee. The other speakers were Sir W. Roberts-Austen, Prof. C. Le Neve Foster, Prof. Perry, Mr. Bennett H. Brough, Mr. H. Hatfield, Mr. Teall, Mr. F. W. Harbord, Mr. E. Woakes, and the present secretary, Mr. H. C. McNeill.

MR. SAMUEL BARBER informs us that a very brilliant meteor was observed at Chesterton, near Peterborough, on January 28, about 5.56 p.m. Attention was drawn to the meteor by an almost blinding flash that resembled lightning. Then the ball of light was observed "travelling across the sky like a large rocket, in an easterly direction, and with a conspicuous trail a few degrees wide on either side of its course. Before vanishing there was a distinct gap left, in which the trail did not appear, *i.e.* between the point of departure of the meteor and the end of the trail. The meteor disappeared instantaneously. No sound was heard."

THE researches undertaken by the Institution of Mechanical Engineers were referred to in the report of the council, presented at the annual meeting on January 26. The fifth report of the research committee on alloys was presented and fully discussed a year ago, and Sir William Roberts-Austen, the reporter, is now at work upon the effect of annealing and tempering on the properties of steel, which will form the principal subject of the next report. The gas engine research has been further advanced by Prof. Burstall, who hopes to be able to present his report early in the present year. The value of the steam-jacket is the subject under investigation by Prof. Beare, who has accumulated further data towards his fourth report. The compound steam-jacketed condensing engine at King's College, London, has been working. Prof. Capper has not yet been able to commence the first series of complete tests, but promises his first report soon.

THE annual general meeting of the Mathematical Association was held at University College on Saturday, January 27, the President of the Association, Sir Robert S. Ball, being in the chair. Papers were read by Sir Robert Ball, Prof. R. W. Genese, and Messrs. R. F. Davis and J. A. Third; and several other papers were received, the authors of which were unable to be present. It was announced that the *Mathematical Gazette* would in future be issued six instead of three times a year. The aim of the Association in publishing the *Gazette* is to supply a journal which is of direct and special interest to mathematical teachers. It is intended that among its special features shall be articles suggestive of improvements in

methods of teaching, or covering ground not satisfactorily treated in text-books, and reviews of books of the first importance, or groups of text-books on kindred subjects, giving an elementary presentation of the history and treatment of the subject. Vol. ii., which commences with the present year, will contain a series of articles by Prof. C. A. Scott, on von Standt's *Geometrie der Lage*.

PROF. A. E. WRIGHT describes in the *Lancet* the statistical results of the anti-typhoid inoculations made by him among British troops at a series of military stations in India. It appears that altogether 11,295 men were under observation, of whom 2835 had been inoculated and 8460 had not. The percentage of cases of typhoid fever amongst the uninoculated was 2·5, and amongst the inoculated 0·95, a difference sufficiently great to warrant further extensive trials taking place. With regard to the mortality the results are not so marked. Amongst the uninoculated the percentage of deaths was 0·34, and amongst the inoculated 0·2. A certain measure of protection seems thus to have been conferred by the inoculation of the quantities of dead typhoid culture, and when Prof. Wright's remarks on the conditions under which the inoculations were carried out are considered this conviction becomes intensified. For instance, the inoculated men were, taken as a whole, men who were much more liable to contract typhoid fever than the uninoculated men, for the inoculated consisted to a large extent of young men who had only recently arrived in India, while the uninoculated consisted mainly of older and more seasoned—in other words, of less susceptible—individuals.

THE relations of forest fires to insect ravages, insects to forest fires, diseases of trees to insects, and insects to fungous diseases, are not obvious at first sight, but Dr. A. D. Hopkins shows in a report on the insect enemies of forests in the north-west, just issued by the U.S. Department of Agriculture (Division of Entomology), that there is a close connection, and, to a certain extent, inter-dependence, of all these factors in the destruction of valuable forest products. Trees dying from injury by fires, or weakened in vitality, offer favourable conditions for the multiplication of vast numbers of destructive insects. Moreover, trees which have been killed by insects furnish, in their fallen branches, standing and fallen partly decayed trunks, and dry bark, a most favourable condition for the starting, rapid spread, and perpetuation of forest fires. It is well known that forest trees weakened by disease contribute to the multiplication of their insect enemies; therefore the study of the insects associated with unhealthy forest trees should lead to results of economic importance. As an example of insects contributing to the spread of fungous diseases, Dr. Hopkins reports that the heartwood of the white fir throughout the region examined by him was commonly rendered worthless by decay as the result of wounds in the living bark made by Scolytus bark beetles.

THE *Scientific American* states that one of the most interesting exhibits which will be sent from the United States to Paris for the forthcoming Exhibition will be a huge map of New York city, which is now in progress of construction under the chief topographical engineer of the Board of Public Improvements. It measures 28 feet by 24 feet, and is on a scale of 600 feet to the inch, and includes all the boroughs of the great city and a large part of the adjoining territory. The map shows all the trees, parks, piers, ferries and railway lines, and displays contour lines and elevations of every point in the city; more than 1,000 square miles of the territory are embraced, and all buildings of any importance whatever are indicated.

TWO novel swing-bridges over the river Weaver at Northwich were described by Mr. J. A. Saner at the meeting of the Institution of Civil Engineers, on January 23. Owing to the nature of the foundations in the salt district, which, as is well known, are seriously affected by the abstraction of brine and salt from the subsoil, the design of the bridges presented unusual difficulties. The average subsidence at the Northwich bridge has been about 4½ inches per annum during the last seventeen years, necessitating the raising of the girders to give headway for the river traffic; and it being impossible to raise the streets in the immediate neighbourhood without partially burying or raising the adjoining houses, the road gradients have become as steep as 1 in 11. To obviate this inconvenience, and to provide for the more efficient carrying on of the salt and other trades on the Weaver, and also with the idea of eventually passing coasting vessels with fixed masts, two exactly similar swing-bridges have been built a little distance apart, in order that one may be available in case of a breakdown.

THE superstructure of the two new bridges at Northwich, each of which may be considered as weighing 300 tons, is supported by a roller path and rollers, which in turn are carried upon a set of piles, strongly braced together. Connected with, and exactly under the centre of gravity of, the superstructure is a circular pontoon or buoy, divided into two chambers. This pontoon has the appearance of being suspended from the superstructure, and in reality would be if the water were not present, as it is entirely clear of both bottom and sides of the chamber in which it is placed. Of this large buoy the lower chamber, which has a displacement equal to 250 tons, is perfectly watertight and always submerged, so that its displacement is practically constant. The upper chamber is open at the top, and either serves as an access to the lower chamber; or, by varying the amount of water allowed to enter it, increases or decreases the buoyancy of the whole. It will be seen that the downward pressure on the rollers and paths, due to the weight of the superstructure, is partially counteracted by the upward tendency of the pontoon, and is thus reduced, in the case under consideration, to 300 − 250 = 50 tons. By emptying the upper part of the pontoon this may be further reduced within certain limits. The difficulty presented by subsidence entailed careful consideration as to the motive-power to be adopted for the bridge. Pressure pipes of any kind being inadmissible, Mr. Saner decided to adopt electrical power, and to use wire rope for turning, as giving the most flexible connection between the bridge and motor. The bridges are moved with remarkable facility, and the consumption of current after they had been working a short time, and all the bearings, &c., were free, only amounted to ¼ a Board of Trade unit for the complete cycle of operations, viz. withdrawing wedges, opening and closing the bridge, and replacing the wedges.

WE have received Part i., vol. xi., of the *Indian Meteorological Memoirs*, containing the observations recorded during the solar eclipse of January 22, 1898, at 154 stations, seven of which were in close proximity to the central line of totality. The observations were taken at intervals of five to fifteen minutes, and includes the barometer, thermometer, wind and cloud, and occasionally other elements. These have all been reduced and tabulated in the Calcutta Office according to Madras time, and are, therefore, in this respect, strictly comparable. Beyond this, no attempt is made to discuss the data. In looking over the observations at the stations of greatest obscuration one is struck by the fact of the lull of the wind at the time of total eclipse. For instance, at Seoni, where full obscuration lasted from 1h. 27m. to 1h. 28¼m. p.m., the observer remarked, "Everything quite quiet and calm, wind totally stopped from 1h. p.m. to 2h. 10m. p.m." The decrease of temperature amounted to about 5° at several places.

THE Report of the Meteorological Council for the year ending March 31, 1899, has just been issued. The Office continues, as in the past, to collect data relating to the meteorology of the ocean, for which purpose complete outfits of meteorological instruments are supplied to officers of the Mercantile Marine who are willing to take observations. The number of such ships supplied during the year was 114. All ships in the Royal Navy are also supplied with instruments, and the Council receive valuable observations from this source. The results of the weather forecasts issued by the Office show a complete or partial success of 83 per cent. during the year 1898; the average success during the last ten years is 81·4 per cent. The special hay harvest forecasts issued to a number of selected stations attained an average success of 89 per cent., and in the district which includes the south of England the complete and partial success reached the high figure of 96 per cent. The Office continues to subsidise and to retain an intimate relationship with a small number of observatories of the highest class; the information from these is supplemented by observations at stations where the observers are volunteers. Among the miscellaneous investigations may be mentioned those on atmospheric electricity, by Mr. C. T. R. Wilson, of Cambridge, and the diurnal range of rainfall, by Mr. R. H. Scott. An appendix to the Report contains a correspondence relating to allowances made by the Meteorological Council to the Ben Nevis Observatories. For some time past the Council have also had under their consideration the necessity of making systematic provision for superannuation allowances to members of the staff. Such allowances will apparently have to be provided from the vote for meteorological observations, and reductions in some directions will have to be made in order to provide the means for a satisfactory arrangement. It is hoped that this may be effected without any material diminution of the scientific usefulness of the Office.

TWO communications on telegony and the inheritance of acquired characters have recently appeared;—the one, in the December number of the *American Naturalist*, taking the form of a critical review of Prof. Ewart's "Penycuik Experiments," and the other, a paper by Mr. C. J. Bond in the *Transactions* of the Leicester Literary and Philosophical Society, describing some experiments in rabbit-breeding and plant-grafting. While giving his adherence to Prof. Ewart's conclusions, the former writer urges the needs of further experiments on the same lines. Mr. Bond likewise ranges himself on the same side, stating "that the evidence in favour of the transmission of acquired, as opposed to congenital characters, breaks down in that group of cases in which the supposed occurrence of telegony was thought to prove such transmission; that the explanation of this phenomenon is reversion, and that this may also account for certain phenomena following budding and grafting in plants. Many of the remaining results can be explained by the direct action of the pollen on the maternal tissues without inheritance."

IN the above-mentioned issue of the *American Naturalist*, Mr. C. E. Mead makes the important announcement that in New Mexico a beetle of the genus *Collops* has been observed feeding on the larva of the dreaded Colorado potato-beetle. This leads to the belief that the main crop of potatoes in the district in question is mainly saved by the predaceous habits of the *Collops*, whose presence seems worth many hundreds of dollars to the potato-growers of San Juan county. If this be substantiated, steps should be immediately taken to introduce the *Collops* into other districts affected by the Colorado beetle.

THREE papers on Wehnelt's interrupter form a noteworthy feature of the *Atti dei Lincei* viii. (2) 12. Drs. R. Federico and P. Bacei have determined the form and frequency of the interruptions by allowing the current to circulate round a solenoid, by which magneto-optic rotation is produced, and thus obtaining a photograph in which the interruptions are represented by light bands on a dark ground. The conclusions are (1) that the interruptions do not alway occur at equal intervals; (2) the interruptions are of short duration, averaging about one-sixth of the interval between them; (3) during the interruption the current does not absolutely cease, but only falls to a minimum; (4) a magnetic field does not affect the number of interruptions per second, but reduces their duration; (5) the frequency of the interruptions varies with the electrolyte, a solution of bichromate and sulphuric acid giving a frequency 1½ times greater than with a solution of sulphuric acid only; (6) the bichromate solution does not become turbid, and its heating is less than with sulphuric acid. Dr. O. M. Corbino investigates, among other results, the mathematical expressions determining the form of the interruptions as deduced from the equations of mutual and self induction, assuming the phenomenon to be due to Joule's law. In a subsequent paper, Dr. Corbino investigates the dissymmetry of the currents obtained in the circuit of a transformer when the current in the primary is broken by Wehnelt's interrupter.

THE whole of the October number of the *Journal of Comparative Neurology*, comprising 302 pp., and five beautifully coloured plates, is devoted to an elaborate memoir by Mr. C. J. Herrick on the nerve-components of the bony fishes, as exemplified by the cranial and first spinal nerves of *Menidia*. For the benefit of those not familiar with the theory of nerve-components, it may be mentioned that this is an extension to the cranial nerves of what has been already done for those of the spinal system, which (not to refer to the "four-root theory") are divisible into motor and sensor portions. Similarly the cranial nerve-trunks may contain several varieties of sensory fibres, having different functional and morphological relations, certain of which may be present in a single segmental nerve. In spite of many technical difficulties, and our imperfect knowledge of their exact relations, enough has been accomplished to permit of the statement that the several lobes of the medulla oblongata, so characteristic of fishes, may be associated with the respective cutaneous or visceral sense-organs as definitely as the olfactory nerves are associated with the olfactory lobes, or the electric lobes of the torpedo with its electric organs. An excellent example of this association occurs in the so-called "sea-robins," in which certain free rays of the pectoral fins have become modified into finger-like tactile organs, while their sensor nerves, together with the corresponding dorsal nerves of the spinal cord, have been enormously hypertrophied. Although the criteria of the nerve-components are primarily the central and peripheral distribution of the nerves themselves, it has been found in practice that in fishes each component has certain definite and characteristic structural peculiarities, by means of which it may be at once recognised, thus rendering the work of the investigator much easier than would otherwise be the case.

AMONG the several interesting papers contained in the last numbers of the *Izvestia* of the Russian Geographical Society, we notice especially one, by General Tillo. It deals with the results of the meteorological observations which were made for two years in the Lukchun depression of Central Asia, in connection with the expedition of Roborovsky and Kozloff. This depression was discovered, as is known, by the brothers Grum-Grzimailo. Owing to the absence of places in the neighbourhood of the Lukchun, the altitude of which would have been measured geometrically, it is evidently impossible to finally determine the real altitude of the depression; but from three separate comparisons of the observations of the barometer which were made at this place from November 1893 to October 1895

with those made at Barnaul and Irkutsk, as also with the normal isobars, General Tillo comes to the conclusion that the probable altitude of Lukchun must be 17 metres below the sea-level, with a probable error of ± 15 metres. The spot where the barometer was observed is not, however, the lowest part of the depression, as its altitudes are in different places from 36 to 110 metres *below* that place—thus giving negative altitudes as deep as 130 metres ± 15 metres below the sea-level at Tash-tura. A good map of the depression is given with the paper. Besides, the meteorological observations made at Lukchun are most interesting in themselves, as it appears from them that the yearly amplitudes of the barometer are greater at this place than anywhere on the earth—the monthly averages for January being by full 30 mm. in excess of those for July, while the daily amplitudes in the winter are as great as in some tropical lands. The highest temperature observed in July (48° C) is also one of the highest observed in Continental Asia, and is truly Saharian. So is also the dryness of the air.

A PAPER, on a "New Basis for the Foundation of Geometry," has been issued, bearing the signature "E. G. L," but whose author invites criticisms addressed to Mr. F. Wheatcombe, of Manchester. The writer of the paper is by no means alone in his ideas as to Euclid's treatment of parallel lines, his definition of a plane angle to the exclusion of straight angles and other such matters being unsatisfactory. As he contemplates writing a book on the subject, we only hope that he will first have studied the considerable mass of existing literature upon it ; and if the work is to be properly treated the author should be versed in non-Euclidian as well as Euclidian geometry. The persistent survival of Euclid's "Elements" as a text-book on geometry is mainly due to his sequence of propositions, stereotyped and standardised by constant usage, affording teachers a common starting point. Many have tried to improve on Euclid ; but as long as scarcely two people think alike as to how this is to be done, so long will their proposals fail to take root.

THE January number of the *Philosophical Magazine* contains a paper, by Dr. C. Davison, on earthquake sounds, a somewhat neglected branch of seismology. The sound is described as generally deep and rumbling, like that of a heavy waggon passing ; sometimes it resembles thunder or wind more closely, the fall of heavy stones, or the firing of distant cannon. Near the epicentre of the earthquake, loud crashes are heard by some, but not all, observers at the time when the shock is strongest ; further away, it becomes rougher and more grinding at this moment ; while at a great distance, the sound is throughout smooth and almost monotonous like the low roll of distant thunder. The neighbourhood of the sound to the lower limit of audibility is shown by the fact that it is heard by some observers, as say, like the rumbling of a heavy traction-engine passing, while others equally alert hear no sound at all. To different auditors of the sound, it also varies in character and duration for the same reason. In this country, practically every earthquake is accompanied by sound, which both precedes and follows the shock ; in Japan, the sound is frequently absent even from violent earthquakes, it is seldom heard more than a few miles from the origin, and rarely, if ever, follows the shock. It would therefore appear that the Japanese as a race are inferior to us in their powers of perceiving deep sounds. In strong earthquakes, the sound-area occupies a region surrounding the epicentre ; in weak ones, the sound-area and disturbed area approximately coincide, or the former area overlaps the latter ; while in certain districts the sound is sometimes heard without any shock being felt. Several instances of these earth-sounds are given, and it is urged that they are merely earthquakes too weak to be felt. Dr. Davison believes that earthquakes are caused by fault-slips, and that the sound-vibrations come chiefly from the margins of the area of displacement. He shows that this theory will account for all the known phenomena of earthquake-sounds.

IN the *Proceedings* of the Liverpool Geological Society (Part 3, vol. viii., 1899) we have an address from the ex-President, Mr. J. Lomas, in which he deals with the characteristic lithological characters of the principal geological systems. In another article he describes and figures "some flint implements found in the glacial deposits of Cheshire and North Wales." Concerning the artificial form of some of these, Mr. W. J. Lewis-Abbott speaks with confidence, whereas Sir John Evans remarks "No. 7 may be artificial. Of the others, Nos. 2 and 3 look the most possible ; but the signs are not such as can confidently be relied on. If man existed in pre-glacial times in Britain, it is, I think, probable that his tools would have been of larger proportions." Mr. Mellard Reade describes a great boulder of gypsum which was found at Great Crosby ; he also enumerates the Foraminifera found in samples of Cheshire boulder-clay. Mr. G. H. Morton describes his geological map of Liverpool, and Mr. T. H. Cope deals with the gabbro of Llyn Eigiau, above the valley of the Conwy.

THE *Journal de Physique* for January reprints an article on the Phase rule of Prof. Willard Gibbs, taken from the introduction of the work by Mr. Wilder D. Bancroft. In this article, the rule in question is very simply explained.

THE *Bulletin* of the Cracow Academy (November) contains a continuation of M. P. Rudski's researches on the elastic deformations of the earth. It deals with the deformations produced by glacial deposits or by the formation of coral reefs.

ON account of the comparatively dull light of the English climate, the lenses usually possessed by Kodaks and other hand-cameras have too small an aperture to be used for many purposes. Messrs. Taylor, Taylor and Hobson have, therefore, at the request of many photographers, made arrangements for refitting such cameras with their well-known Cooke lenses. As the lenses can be attached to almost any hand-camera now upon the market, their rapidity will soon be widely known.

As in previous years, the "Annuaire" of the Brussels Observatory contains particulars of the principal astronomical occurrences for the current year, geographical information, tables of physical and chemical data, and other statistics of frequent service in scientific work. The articles include a discussion of the meteorological observations of 1899, and of the direction of the wind at Brussels, by M. Lankaster ; on the use of the kite in meteorology, with a bibliography of the subject, by M. Vincent ; the climate of the Belgian coast, by M. Durieux ; the population of Europe, by M. Lankaster ; reports on various branches of astronomical and meteorological work carried on last year, and an instructive description of the determination of the co-ordinates of sun spots, by M. Niesten.

MANY workers with the microscope have been guided in their early "dabblings" by the late Rev. J. G. Wood's "Common Objects of the Microscope" (Routledge and Sons), and not a few can doubtless recall their failures in the attempt to mount seeds in Canada balsam and their disappointment that the medium refused to set in six to eight hours. A new edition of this deservedly popular book has now appeared, revised and brought up to date by Mr. E. C. Bousfield. The late Mr. Tuffen West's familiar illustrations appear to have been re-engraved, and fly leaves with lists of the figures are now attached to the plates, while Mr. Bousfield has added two plates of his own drawing illustrative of pond life. The new letterpress includes a brief account of the optics of magnification, and the use of the substage condenser (brought into general use since the first edition of "Wood") in the introductory chapters, and

information on fixing, hardening, imbedding, sectioning and staining, also on selecting diatoms, in the chapters on "mounting" now at the end of the book. The number of pages has been increased from 132 to 186.

A NEW method of attacking the problem of determining the degree of ionisation of complex solutions is given by Prof. J. G. Macgregor in the *Transactions* of the Nova Scotian Institute of Science just issued. The number of free ions per unit volume can be studied in the case of the two simple salts separately by means of the conductivity. These numbers are functions of the dilution, and can be expressed graphically in the form of curves. From these two curves, by a neat graphical construction, Prof. Macgregor deduces the concentration of the ions in the solution resulting from the mixture of the two simple solutions, a complicated algebraical process being thus avoided. The method is applied, in a subsequent paper in the same volume by Mr. J. Barnes, to solutions containing a common positive ion, potassium chloride and sulphate. It was found to be possible in this way, given the dissociation theory and data obtainable from simple solutions, to predict the electrical conductivity, specific gravity and surface tension of fairly dilute solutions of potassium chloride and potassium sulphate within the limits of experimental error.

NOTHING can be more striking testimony to the advance of physical chemistry than the manner in which isolated phenomena, long known but previously unexplained, fall into line when attacked by modern methods. An excellent example of this is afforded by the paper of Messrs. Cohen and Van Eijk in the current number of the *Zeitschrift für physikalische Chemie* on physico-chemical studies of tin. As early as 1851 a curious molecular transformation of some tin organ pipes was noticed by Erdmann, and the same fact was rediscovered eighteen years later by Fritzsche at St. Petersburg, the tin crumbling to a grey powder. Since that time this phenomenon has been repeatedly studied by various observers, the causes being variously ascribed to low temperature, effect of shocks upon the crystalline structure, and velocity of cooling of the tin when originally cast. A preliminary dilatometric study of a grey tin showed the existence of a transition temperature at about 30° C., hence a transition element was constructed, having grey tin as one electrode and ordinary white tin as the other. A study of the electromotive force of this cell with varying temperatures showed that the reaction

$$\text{grey tin} \rightleftarrows \text{white tin}$$

was a reversible one with a transition point at 20° C. A careful determination of the same point by the dilatometric method gave the same value. All the observations of early workers are brought into line by this work. The authors point out that, except during a few warm days, all tin is in a metastabile equilibrium, and tends to transform itself slowly into the grey powder modification.

THE additions to the Zoological Society's Gardens during the past week include a Geoffroy's Cat (*Felis geoffroii*) from Paraguay, presented by Mr. W. A. Gillett; a Woodcock (*Scolopax rusticula*), British, presented by Mr. C. E. Lambert; a Common Snake (*Tropidonotus natrix*), British; a Tesselated Snake (*Tropidonotus tessellatus*), a Dark Green Snake (*Zamenis gemonensis*), European, presented by Miss Ash; a Black-headed Lemur (*Lemur brunneus*) from Madagascar, a Blue-tongued Lizard (*Tiliqua scincoides*) from Moluccas, a Bare-eyed Cockatoo (*Cacatua gymnopis*) from South Australia, two Undulated Grass Parrakeets (*Melopsittacus undulatus*, var.) from Australia, two Common Teguexins (*Tupinambis teguexin*) from South America, an Eyed Lizard (*Lacerta ocellata*), European, deposited; a Black-headed Bunting (*Emberiza melanocephala*), bred in the Gardens.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN FEBRUARY.

February 2.	6h. 56m. to 7h. 43m.	Occultation of κ Piscium (mag. 5·0) by the moon.
2.	11h. 44m.	Minimum of Algol (β Persei).
2.	18h. 5m.	Transit (Ingress) of Jupiter's Sat. III.
5.	8h. 33m.	Minimum of Algol (β Persei).
6.	8h. 36m. to 9h. 24m.	Occultation of δ Arietis (mag. 4·5) by the moon.
7.	14h. 3m. to 14h. 49m.	Occultation of 56 Tauri (mag. 5·4) by the moon.
8.	15h. 50m. to 16h. 29m.	Occultation of n Tauri (mag. 5·2) by the moon.
14.	Venus.	Illuminated portion of disc = 0·801.
15.	13h. 20m. to 14h. 40m.	Occultation of 55 Leonis (mag. 6·0) by the moon.
19.	Saturn.	Outer minor axis of outer ring = 16″·13.
22.	16h.	Jupiter in conjunction with moon. 1° 31′ N.
25.	10h. 15m.	Minimum of Algol (β Persei).
28.	7h. 4m.	Minimum of Algol (β Persei).

UNITED STATES NAVAL OBSERVATORY.

CAPTAIN C. H. DAVIS, Superintendent of the United States Naval Observatory at Washington, has forwarded a copy of his report for the fiscal year ending June 30, 1899.

The great equatorial, 26 inches aperture, has been devoted to work beyond the reach of smaller instruments, and in particular to the spectroscopic determination of the motions of stars in the line of sight. Many measures were made of the diameters of Mercury and Venus, to determine the irradiation error, and it was established that this was a function of the magnifying power employed.

The spectroscopic observations were almost all made by the photographic method, the wave-lengths being obtained from measures taken with the large Harkness comparator made for eclipse reduction in 1869. The probable error in the velocity, as determined from a single plate, was about ± 0·71 mile per second. Good plates with well exposed comparison spectra have been obtained of α Tauri, α Aurigæ, α Canis Majoris, α Canis Minoris, α Cygni and ϵ Cygni, but many others have been failures, owing to the difficulties involved in the use of a lens only visually corrected. This has recently been remedied by the purchase of a correcting lens of 2·09 inches aperture, which alters the minimum focus from λ 5270 to λ 4341 without materially disturbing the total focal length from the object-glass. Extensive alterations have been made in the endeavour to remedy the air currents produced in the equatorial building on account of its connection with other rooms. The 12-inch equatorial has been employed in the systematic observation of minor planets, comets, occultations of stars and eclipses of Jupiter's satellites, the whole of which have been reduced and published. This telescope has also been used for the exhibition of celestial objects to the public on Thursday evenings. Including those admitted during day working hours, the number of visitors during the year has been 1623.

Transit observations have been continuously made throughout the year. The 9·14-inch instrument was dismounted on June 5, 1899, the whole observing staff being immediately transferred to the new 6-inch transit circle. The temporary fittings supplied at the installation of the 9·14-inch transit in 1893 are being replaced by permanent ones of new design. A meridian mark has been provided for the 6-inch instrument, and the performance of both this and the new steel altazimuth have given every satisfaction.

The new 5-inch altazimuth and the prime vertical instrument have been employed for determining variations of latitude and the constants of aberration and nutation.

The 40-foot photoheliograph was installed, for obtaining sun pictures, on October 11, 1898, and from this date to June 30, 1899, negatives were taken on 122 days. The sun's disc on these plates is 4·3 inches in diameter. The publications of the Observatory are well in hand. Volumes of observations for 1891 and 1892 are almost ready for distribution, and these will complete the record of work done at the old Naval Observatory. The American ephemeris for 1902 is issued, and it is hoped that the volume for 1903 will be issued in February 1900. In this, the adopted value of the apparent diameter of the sun will